International Capital Flows, Federal Budget Deficits, and Interest Rates, 1971-1984

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This study investigates the impact of federal budget deficits on both short- and long-term interest rates from 1971 to 1984 within an open IS-IM model that includes net international capital inflows. Two time periods are examined using quarterly data: 1971.4 to 1984.4 and 1979.4 to 1984.4. Short-term rates are unaffected by the federal. budget deficit in both periods. Long-term rates are an increasing function of the deficit over the 1971.4 to 1984.4 period, but are relatively unaffected by budget deficits during the 1979.4 to 1984.4 period. The evidence implies that net international capital inflows over the latter period offset the interest rate effects of the federal deficit.

INTRODUCTION

The impact of federal budget deficits on the rate of interest has been studied extensively.[1] Most of these studies focus on the short-term rate of interest, especially the three month U.S. Treasury bill rate or the four to six month commercial paper rate; a few of these studies focus on long-term rates of interest, such as the ten year U.S. Treasury note rate, the 20 year U.S. Treasury bond rate, the Moody's Aaa-rated corporate bond rate, or the Moody's Baa-rated corporate bond rate. The various studies have focused on different time periods, principally between the years 1954 and 1984.

There is no consensus regarding the interest rate impact of the budget deficit. Many of the studies that focus on the short-term rate of interest find that the deficit exercises no significant impact, although there are exceptions (cf. Barth, Iden, and Russek, 1984; 1985; Cebula, 1987; Tanzi, 1985; and Zahid, 1988). A majority of the studies that focus on the longer-term rate of interest, however, find that the deficit does exercise a positive and significant impact, although there are a number of exceptions (cf. Evans, 1985 and 1987; Mascaro and Meltzer, 1983). Unfortunately, interpretation of results is complicated by differences in the time periods examined in the various studies. Several studies deal with the period 1955 to 1984; others deal with time periods such as 1979 to 1983 (using monthly data); still others begin with the year 1971 or 1972 or roughly the time period when the regime of fixed exchange rates (Bretton Woods) began to collapse and net international capital flows into the United States began to grow enormously. Because of the latter considerations, different time periods involve different macroeconomic circum-

[1] For example, see Barth and Bradley (1989), Barth, Iden, and Russek (1984, 1985), Barth, Iden, Russek, and Wohar (1989), Cebula (1987, 1988), Evans (1985, 1987), Feldstein and Eckstein (1970), Hoelscher (1983, 1986), Johnson (1992), Makin (1983), Mascaro and Meltur (1983), McMillin (1986), Ostrosky (1990), Tanzi (1985), and Zahid (1988).

stances. Most of the studies dealing with the time period beginning in the em_.Iy to late 1970s have two trails in common:

- They generally find lhat federal budget deficits in the United States do not influence interest rates; and
- They generally omit international capital flows from their models.

Johnson (1992, pp. 1 45-146) recently has observed Uiat it is essential for us to " ... understand why the data consistently support mutually exclusive views concerning the impact of debt financing. For a question that has far-reaching policy implications, this ambiguity is not acceptable." Accordingly, to identify the impact of federal budget deficits on interest rates in the United States from 1971 to 1984, this study seeks to investigate empirically the impact of both the choice of interest rate measure and of time period studied upon the interest rate impact of the federal budget deficit.

The model examined below uses quarterly data, deals with five different interest rate measures, includes net international capital inflows, and examines two different time periods. The empirical analysis demonstrates that both the choice of interest rate studfod and the time period studied affecrthe empirical results obtained.

THE MODEL

The analysis is couched within the familiar IS-LM framework, although a standard loanable funds model can be shown to yield nearly identical conclusions. This study empirically examines the open economy version of the standard IS-LM model. As noted in Hoelscher (1986) and Johnson (1992), this model basicclly differs from the closed IS-LM model by including net international capital inflows [NCAP].

Following Cebula (1987), Evans (1985), Makin (1983), and Ostrosky (1990), we assert that, according to the IS-LM paradigm, the nominal rate of interest (R) is determined principally hy real government purchases of goods and services (G). the real budget deficit (D), the real exogenously determined money stock (M), and expected inflation (P):

(1) $R = R(G, D, M, P)$

where we expect:

(2) $R_G > 0, R_D > 0, R_M < 0, R_P > 0$

with subscripts denoting partial differentiation.

Following Hoelscher (1986) and Johnson (1992), the open IS-LM model is a modified version of equation (1) that includes net international capital inflows (NCAP):

(3) $R = R(G, D, M, P, NCAP)$

where we expect that:

(4) $R_{NCAP} < 0$.

The greater is the net inflow of foreign capital, the less is the upward pressure on R because the capital inflow in question acts to absorb newly issued debt

Based on equations (2) through (4), we estimate a reduced form interest rate equation. In this system, aside from the interest rate and expected inflation, all of the explanatory variables are divided by variable Y., the actual level of GNP in the economy in quarter t Variable Y, is a standard measure of the size of the United States economy. We divide variables by Y, for two reasons: first, it allows for the secular growth over time of variables in the system; second, government purchases, the budget deficit, open market operations, and net capital inflows should be judged relative to the size of the economy so that we have a relevant criterion against which to evaluate them and their magnitude,

The reduced form equation to be estimated is given by:

$$(5)\ R_t = a + bG_t/Y_t + cD_t/Y_t + dM_t/Y_t + eP_t + fNCAP_t/Y_t + u$$

where:

R, = The nominal average interest rate yield in quarter t, expressed as a percent per annum;

a = Constant term;

G,/Y, = The ratio of the seasonally adjusted federal government purchases of goods and services in quarter t to the seasonally adjusted GNP in quarter expressed as a percent;

D,/Y, = The ratio of the seasonally adjusted total federal budget deficit (National Income and Product Accounts) in quaner t to the seasonally adjusted GNP in quarter t, expressed as a percent;

M,/Y, = The ratio of M,, which is defined as the average of the current and preceding quarters' values of the seasonally adjusted net acquisition of credit market instrumeuts by the FED, to the seasonally adjusted GNP in quarter expressed as a percent;

P, = The expected inflation rate for quarter t, expressed as a percent per **annum**

NCAP,/Y, = The ratio of seasonally adjusted net capital inflows in quarter t to the seasoually adjusted GNP in quarter expressed as a percent;

u = Stochastic error term;

and where we expect that b, c, e > 0 and d, f < 0,

In accord with our objectives, we examine five nomiual interest rates; that is, R, assumes five different forms:

- TBR,, the three month U.S. Treasury bill rate in quarter t;
- CPR,, the four to six month commercial paper rate in quaner t;
- TEN,, the ten year U.S. Treasury note rate in quarter t;
- AAA,, the rate on Moody's Aaa-rated corporate bonds in quarter t;
- BAA,, the rate on Moody's Baa-rated corporate bonds in quarter t,

These rates are all expressed as a percent per annum. fhese five rates are the most commonly studied rates in this literature.

The variable G, consists strictly of federal government purchases of goods and services and does not include transfer payments (such as unemployment compensation and Social Security). Variable G, is expressed in billions of current dollars.

The federal budget deficit, D,, is the seasonally adjusted total federal budget deficit, expressed in billions of current dollars. Variable D, consists of an exogenous component, the so-called structural deficit, and an endogenous component, the so-called cyclical deficit. (See Barth, Iden, and Russek, 1984 and 1985; Cebula, 1987 and 1988; Holloway, 1986; and Ostrosky, 990.)

Variable M, is adopted to reflect United States monetary policy. Following Barth, Iden, and Russek (!984; 1985), Cebula (1987), Hoelscher (1983), and Ostrosky (1990), M, is computed as a two quarter moving average. M, also is expressed in billions of current dollars.

The data for tl1e expected inflation variable were obtained from TI1ies (1986).[2] These data are expressed as a percent per annum and are available through the end of 1984.

The variable NCAP, is the seasonally adjusted net foreign financial capital inflow into the United States in quarter t. This variable is expressed in billions of current dollars.

Finally, the seasonally adjusted GNP data (Y,) are expressed in billions of current dollars. As shown in equations (5) and (6), we follow a number of earlier studies in principle, including Barth, Iden, and Russek (1984), Evans (1985; 1987), Hoelscher (1983; 1986) and Holloway (1986), and divide G_t, D_t, M_t, and $NCAP_t$ by Y_t; as noted above, this is in part because the level of government purchases of goods and services, the budget deficit, monetary policy actions, and net capital inflows should be judged relative to the size of the economy.

EMPIRICAL ANALYSIS

The Hausman specification test rejects at the 5 percent level the null hypothesis of exogeneity for three of the explanatory variables in the reduced fonn interest rate equation: the budget defici expected inflation, and net international capital inflows.

Because the total budget deficit is partly endogenous, its inclusion in the analysis introduces the possibility of simultaneous equation bias. Accordingly, we estimate equation (5) using au instrumental variables (IV) technique, with the instrument being the two quarter lag of the seasonally adjusted quarterly unemployment rate of the civilian labor force (U,_2). Our choice of instrument is based upon the fact that previous studies have used this same instrument satisfactorily to address the endogeneity of tl1e budget deficit (Cebula, 1988; Ostrosky, 1990; and Barth Iden, Russek, and Wohar, 1989), as well as the finding that U_{t-2} systematically explains the deficit,[3] whereas the contemporaneous error

[2] Thies (1986) constructs internally consistent time series of business price expectations for the post World War II period. He uses regression analysis to construct a time series of price expectations based on extensive surveys of business price expectations. He pulls together infonnation previously contained only in scattered and apparently different surveys to generate this new time series.

[3] The relationship between the deficit variable and the lagged unemployment rate is shown in the follovving OLS est.irnate:

terms in the system are not correlated with the lagged unemployment rate. As the unemployment rate rises (falls), income lax collect.ions should fall (rise) and government transfers rise (fall), thereby increasing (decreasing) the federal budget deficit automatically.

To allow for the endogeneity of the variable P" we include a second instrumental variable in our analysis: p_{t-2}, the two quarter tag of the actual iufiat.iou rate of the consumer price index. We chose variable p_{t-2} as the instrument because we found that it systematically explains P_t,[4] whereas the contemporaneous error terms in the system are not correlated with this lagged actual inflation rate.

Finally, to allow for the endogeneity of the capital flows variable, we adopt a third instrumental variable, the two quarter lag of the three year U.S. Treasury note rate, $TYTNR_{t-2}$. This choice of instrument is based on our finding that $TYTNR_{t-2}$ systematically explains the capital flows variable,[5] whereas $TYTNR_{t-2}$ is not correlated with the contemporaneous error terms in the system.

The instrumental variables procedure involves first regressing the endogenous explanatory variables on the instruments and other exogenous variables, thereby generating fitted values for the endogenous explanatory variables. We then substitute the fitted values of these explanatory variables for their actual values.

This study examines two different time periods: 1971.4 to 1984.4 and 1979.4 to 1984.4. We begin with 1971.4 because it reflects the period during which the system of fixed exchange rates (Bretton Woods) began to collapse (Zahid, 1988). We end with 1984.4 because this is the last period for which the expected inflation series, obtained from Thies (1986), is available. We also examine a subperiod beginning with 1979.4, when there was a major shift **in** Federal Reserve policy to allow interest rates to seek their own levels. (See Cebula, 1987; Evans, 1985; and Zahid, 1988.)

Alternative time periods could have been studied. Nevertheless, we argue that our choice of time frames is appropriate and reasonable in terms of relevance to contemporary policy issues.

The IV estimates of equation (5) for our five nominal interest rates are provided in Tables 1 and 2. Table 1 provides the estimates for the short-term rates TBR, and CPR, for

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$$D.fY_t = -2.54 + 0.69\, u_{t-2},\ R^2 = 0.42,\ DW = 2.00,\ Rho = -0.03$$
$$\quad (-3.31) \quad (+5.93)$$

where terms in parentheses are t-values. We use the Cochrane Orcut! procedure to correct for first order serial correlation.

[4] **TI1e relationship between P_t and Pt-Z is shown in the following OLS estimation:**

$$P_t = 1.61 + 0.26\, p_{t-2},\ R^2 = 0.50,\ Durbin\text{-}h = 2.13$$
$$\quad (+2.10) \quad (+9.04)$$

where terms in parentheses are t-values. We use the Hildreth-Lu procedure to correct for first order serial correlation.

[5] **The relationship between $NCAP/Y_t$ and $TYTNR_{t-2}$ is shown in the following OLS estimation:**

$$NCAP/Y_t = 0.01 + 0.61\, TYTNR_{t-2},\ R^2 = 0.36,\ DW = 2.05,\ Rho = -0.04$$
$$\quad (+1.76) \quad (+3.80)$$

where terms in parentheses are tvalues. We use the Cochrane-Orcutt procedure to correct for first order serial correlation.

labfe <;-iV Estimates for ShortTenn Nomiina1 interest A.ates.

Rate	Constant	GtfYt	D,IY,	Mt!Y r_	Pl	NCAP1lY1	DW	Rho
1971.4 to !984,4								
TBRt	7.32	-0.32	-0.18	-1.98	0.61	-0.26	1.77	0.I O
	(1.54)	(-1.34)	(-0.79)	(-1.81)	(3.65)	(-2.I5)		
CPRt	8.45	-0.36	-0.31	-1.53	0.64	-0.25	1.75	0.I I
	(1.69)	(-I.19)	(-1.23)	(-1.70)	(3.67)	(-2.12)		
!979.4 to I984.4								
TBR1	6.17	-O.!5	0.05	-1.82	0.70	-0.42	1.78	0.08
	(1.75)	(-0.52)	(0.IS)	(-1.7!)	(3.45)	(-2.92)		
CPR1	7.02	0.I4	-0.I2	-1.23	0.67	-0.40	!.77	0.08
	(1.67)	(0.46)	(-0.36)	(-1.34)	(3.!5)	(-2.91)		

Terms in parentheses beneath coefficients are t-values

1BR1 The three month Treasury bill rate, as a percent per annun1
CPP't TI1e four to six month comrr1ercial paper rate, as a percent per annurn
G/Y1 = 'I1 1e ratio of government purchases to GNP, as a percent
D/Y1 TI1e ratio of the budget deficit to GNP, as a percent.
Mi!Yl 1 1le ratio of net open market purchases to GNP, as a percent.
P1 Expected inflation, as a percent per annuni.
NCAP/Yt = The ratio'Of net capitaLinflows to GNP, a<: a percent.

All data are quarterly observations
Data sources are listed in the appendix
The instruments are U_{1-2}, p_{1-2}, and $TYTNR_{1-2}$, for D/Y t• P_1, and NCAP/Y 1, respectively

each of tl!e two time periods in question. Table 2 preseuts tl1e estimates for the three long-term rates, TEN,, AAA,, and BAA,, for each of the two time periods in question. All of the estimations in Tables l and 2 use the Cochrane-Orcutt procedure to correct for first order serial correlation.[6]

In Table I, the only estimated coefficients that are consistently significant at acceptable levels (5 percent level or better) in explaining shon-tenn rates are tl1ose for expected inflation and net capital inflows. The expected inflation variable has the hypothesized positive sign in all four estimations; the capital flows variable is negative, as expected. Thus, expected inflation appears to raise and net capital inflows appear lo reduce short-t.enn no1ninal rates.

In three of four cases the estimated coefficient on the monetary policy variable, *M,IY.,* is significant at the 10 percent level witl:t the expected negative sign; thus, there is evidence, albeit weak, that open market operations may have influenced short-term rates to some limited extent.

By contras the estimated coefficients on the deficit variable have the hypothesized positive sign in only one of the four estimates in Table 1, and in none of I.he four estimates is the coefficient significant at even the J O percent level. Thus, in all cases tl1e deficil variable fails to exercise a significant impact on the short-term rate of interest.

[6] Unless we use, thic, Cociuane Orcutt procedure, the IJurbin W atson statistic hes between 1.36 aud l.71, which fOr five variables and roughly 50 or fewer degrees of freedom, lies in the range of indeterminacy where one cannot establish the abscuce of serial correlation definitively.

Table 2-IV Estimates for Lono-Term Nominal Interest Rates

Rate	Constant				P,	$NCAP_t/Y_t$		Rho
97L4 to 1984.4								
	5.64	0.19	0.69	-2.34	1.05	-0.35	2.07	-0.03
	(L76)	(0.77)	(2.92)	(·!.34)	(2.72)	(-3.00)		
	6.90	0.25	0.71	**-2.17**	0.95	-0.33	2.02	-0.01
	(J.52)	(0.51)	(2.81)	(-1.32)	(2.88)	(-2.71)		
	6.41	0.35	0.87	-2.70	1.10	-0.35	J.95	0.03
	(1 .73)	(0.67)	(3.39)	(-1.44)	(3.08)	(-2.61)		
1979.4 to 1984.4								
	3.91	**0.29**	0.39	-2.07	0.89	-0.49	I.80	0.0
	(1.56)	(0.48)	(I.71)	(-1.28)	(2.50)	(-3.59)		
AAA,	6.40	0.13	0.45	-2.33	0.79	-0.52	I.78	0.08
	(1.24)	(0.20)	(1.75)	(-1.51)	(2.35)	(-3.60)		
BAA,	5.58	0. 15	0.75	-2.49	0.89	-0.60	!.79	0.07
	(1.55)	(0.24)	(2.19)	(-1.64)	(2.66)	(-3.68)		
1981.4 to 1984.4								
BAA,	5.54	0. 10	0.67	-2.20	0.90	-0.71	1.80	0.08
	(!.09) '	(0.18)	(1.64)	(-1.87)	(3.00)	(-4. 16)		

Terms in parentheses are l-values

$1EN_1$ = The ten year Treasury note rate, as a percent per annum
AAt\ The Moody's Aaa-rated corporate bond rate, as a percent per annum
BM The Moody's Baa-rated corporate bond rate, as a percent per annum
$Gr_/Y_1$ = The ratio of government purchases to GNP, as a percent
IVY_1 = The ratio of the budget deficit to GNP, as a percent
M/\'t = The ratio of net open market purchases to GNP, as a percent
P_1 Expected inflation, as a percent per annum
$NCAP/Y_1$ :::: The ratio of net capital inflows to GNP, as a percent
All data are quanerly observations
Data sources are listed in the appendix
The instruments are Ur.2, Pt.2, and TYTNR 1•2, for Dt/Yt. P" and NCAPt/Yt, respectively

Because this finding holds for both of the time periods considered, it appears that short-lenn rates are insensitive to budget deficits, regardless of the time period studied. This conclusion is consistent with most of the related empirical literature dealing with short-tenn rates.

Table 2 provides the IV results for tlie three long-term rates. For the two time periods 1971.4 to 1984.4 and 1979.4 to 1984.4, 16 of tlie 30 estimated coefficients are statistically significant at the 5 percent level or better. Again, we find that expected inflation is a consistent explanatory variable: in all cases, it is significant at the 5 percent level or better witli the hypothesized positive sign.

The deficit variable (D/YJ exhibits the hypotliesized positive sign in all six estimations. It is statistically significant in three of the six cases at the 1 percent level; it is significant at tlie 5 percent level in one case; and it *is* significant at the 10 percent level in the remaining two cases.

The capital flows variable is negative (as expected) and significant at roughly the 1 percent level in all six estimations. The monetary policy variable is negative in all six estimates, but not significant at the JO percent level.

Table 2 indicates that the budget deficit exercises a positive impact on al! three nmn-inal long-term interest rate measures for 1971.4 to 1984.4. For this period the budget deficit raised the long-tenn nominal rate of interest; this finding holds despite the impact of the statisticall y significant net capital inflows (which lowered that rate of interest).

For 1979.4 to 1984.4 the estimated coefficient on the net international capital inflows variable is negative, as hypothesized, and stat.istically sign.ificant in all cases. The budget deficit variable is significant at the 5 percent level in one of the Jhree cases, but significant **in** tl1e other two cases at onl y the 10 percent level. Th us, net capital inflows appear to exercise a negative and significant impact on all three nominal long-term rates for this period. At the same time, tl1e budget deficit appears to raise the nominal rnte onl y on Baa-rated corporate bonds, whereas the rates on ten year Treasury notes and Aaa-rated corporate bonds do not appear to be affected significantly by the budget deficit. Thus, we conclude that the choice of time period studied may influence the determined impact of tile budget defici even on long-term rates.

Our conclusion is supported furJ1er by the finding that after 1981 the budget deficit did not exercise a significant impact on any of the long-tenn rates, including BAA,. Table 2 also provides the IV estimate of equation (5) for interest rate BAA, for the period 1981.4 to 1984.4. The estimated coefficient on the budget deficit variable is not significant al even tJ1e 10 percent level, whereas the coefficient on the capital flows variable is negative and significant at the J percent level. Thus, tile deficit did not affect BAA" but capital inflows did reduce BAA,. It appears tJ1at the impact of the budget deficit on tJ1e long-tenn rate is influenced significantly by the choice of study period.

CONCLUDING OBSERI/ATIONS

This study has examined the impact of the federal budget deficit in the l Jni ted States **upon a variety of short-term and long-tenn nominal interest rates within a standard open-**economy IS-LM framework. Our principal findings are:

- The shon-tenn nominal rate of interest consistell!Jy is unaffected by the federal budget deficit;
- Tile federal budget deficit appears to have had a positive and significam **impact upon some no1nina1 long-term interest rates;**
- The conclusion that the federnl budget deficit appears to have had a positive and significant impact upon some nominal long-term interest rates holds true for certain time periods but not all; for tile most recent periods (those beginning after 1979.4), even the nominal long-term rate is relatively unaffected by the federal budget deficit.

The finding that long-term nominal rates of interest are apparently more sensitive lo tile budget deficit than short-term nominal rates is perhaps to be expected. For instance, in tJ1e co!tlext of a loanable funds model, Hoelscher (1986) also observes that, empirically speaking, the budget deficit may exercise an impact on !lie term structure: he alleges that the budget deficit raises the slope of the yield curve but does not provide any explanation for this conclusion, On the other hand, within the context of a purely theoretical analysis of the IS-LM framework, Turnovsky (1989) and Turnovsky and Miller (1984) find that government deficits should he expected to exercise an impact on the term structure. Despite the existence of such supportive empirical findings (e,g., Hoelscher, 1986) and theoretical arguments (e.g., Turnovsky, 1989; Turnovsky and Miller, 1984), however, the issue at hand may warrant further analysis.

As for the effect of the choice of time period studied upon the interest rate impact of the budget deficit, an analysis (explanation) also would be desirable. The question seems to he: "Why would the deficit impact less upon the long-term rate during recent years than during earlier years?" The issue may be a rather complex oue, but the answer to some large degree may involve the impact of international capi tal flows on interest rates. As shown in Table 2 (as well as in Table 1 and equation (6)), net capital inflows have acted to reduce nominal interest rates in the United States, especiall y for tl1e period 1979.4 to 1985.4, although their impact is apparent even in the period beginning 1971.4. It may be that the comparatively massive net international capital flows into the United States, especially begiuning with the early 1980s but existing in the late 1970s as well, absorbed large amounts of debtand thus served as a source of savings for the Uni ted States. This issue may he worth examining further, but is beyond the scope of this paper.

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Data Appendix

Variable	Source
	Thies (1986, Table 2)
U1.-2	Holloway (1986)
TBR,, CPR,, TEN,, AAA,, BAA,, 1YTNR,_2	*Economic Report of the President:* 1957, 1959, 1961, Table C-47; 1963, 1964, 1966, Table C-48; 1969, Table B-54; 1971, Table C-57; 1974, Table C-58; 1977, Table B-63; 1978, 1981, Table B-65; 1982, Table B-67; 1987, Table B-68
	Economic Report of the President: 1957, 1959, 1961, 1963, 1964, Table C-1; 1967, 1968, 1969, Table B-1; 1970, 1971, Table C-1; 1972, Table B-1; 1973, 1974, 1975, Table C-1; 1976, 1977, 1978, 1979, 1981, 1982, 1983, 1984, 1986, 1989, Table B-1
M,, NCAP,	*Flow of Funds Accounts,* Federal Reserve System, 1955-1987, via DRI
D,	*Economic Report of the President:* 1957, 1959, Table C-57; 1961, Table C-58; 1963, Table C-59; 1965, Table B-61; 1966, Table C-60; 1968, 1969, Table B-67; 1971, Table C-70; 1972, Table B-70; 1974, Table C-67; 1976, Table B-66; 1978, Table B-73; 1980, Table B-72; 1982, Table B-75; 1984, Table B-75; 1986, Table B-76; 1989, Table B-79
Pt-2	*Business Conditions Digest*, March 1988, p. 98.